

into which the geologists of the Eastern States have been thrown. We hear of the scheme being stigmatised as another example of the infringement of State rights, of the illegal assumption of State responsibilities, and of the danger to private interests as well as public morality to be apprehended from the temptations which such a vastly extended supervision would put in the way of the central authority.

The area in the West yet to be explored is so vast, the problems offered by it so numerous and so tempting, the field so free from "vested interests" of any previous explorers, that we cannot for a moment imagine that Mr. Clarence King and his associates, who, having already cleared a way for themselves through that wide West, know better than any other men its infinite variety and attractiveness, will trouble themselves with the geology of the East, where for generations past the labourers have been so many, and where, comparatively speaking, the field is so small and already so well tilled. With the humour of their countrymen they may have made use of the rather indefinite language of a congressional resolution to scare their less adventurous brethren in the Eastern cities. We would, therefore, counsel the geologists of the East to treat the matter as a joke. They have nothing to fear. It would be as absurd to give the Director of the United States Geological Survey control over the geology of all the States, as to make the Chief Constable of New York comptroller of morals for the whole of the Union.

A. G.

SAHARA AND SUDAN

Saharâ und Sudan Ergebnisse sechsjähriger Reisen in Africa. Von Dr. Gustav Nachtigal. Erster Theil, mit 49 Holzschnitten und 2 Karten. (Berlin, 1879.)

DR. NACHTIGAL'S wanderings came to an end more than six years ago. Most of his results have been brought at various times before learned societies and otherwise published, and the most important parts of his route are laid down in published atlases. The present work contains a detailed account of his entire travels and observations. The book now under consideration is only an instalment extending over his journey up to the end of the year 1870; a second is to follow. The volume is a large octavo of 750 closely printed pages with an appendix containing meteorological observations.

Dr. Nachtigal undertook the duty of conveying to the Sultan of Bornu, the country surrounding Lake Tsad, a present sent by the Emperor of Germany in acknowledgment of the hospitality and assistance afforded by the Sultan to the German travellers, Barth and Overweg, Vogel, von Beurman, and Rohlf. In his journey from Tripolis to Bornu the author passed along the caravan route traversed before by Denham and Clapperton in 1822-23-24, and by Barth and Vogel in 1849-55, and also by Rohlf. During all this portion of his journey he was therefore on ground comparatively well-known from the writings of the above travellers. He made however three long excursions to the eastward, one into Tibesti or Tu, another to Borku, and a third into Bagirmi to the south of Lake Tsad; finally he made his way eastward from Lake Tsad across Wadai and Darfor, to Chartum.

Of the present volume more than two-thirds is occupied

with the account of the journey along the direct route between Tripolis and Bornu, and an account of Fezzan, and of Bornu and its capital, Kuka. The remaining third of the book relates to the journey into the unexplored region of Tibesti and is thus the most interesting and important portion of the work.

Lake Tsad lies almost due south of Tripolis and the caravan route follows an almost straight line between the two points. Dr. Nachtigal left Tripolis on February 18, 1869, and after his wanderings in Tibesti and many mishaps reached Kuka in June 1870. At Tripolis, and also in Murzuq he frequently met with the well-known traveller, Miss Tinne, of whose history and deplorable murder by the Tuaric he gives a full account. Miss Tinne or "the King's Daughter," as she was called by the inhabitants of the country, excited the greatest curiosity and was believed to possess supernatural powers. One story circulated about her at Murzuq was to the effect that her large pet dog which travelled with her was a bewitched man and changed into the human form from time to time.

The fourth chapter deals with the natural characteristics of the district of Fezzan. So scarce and dear are mutton and goats' flesh in Fezzan that recourse is had to minute crustacea and the larvæ of diptera from lakes of brackish water as food. The Bahâr-el-Dûd, or "worm lake," is so full of the larvæ and of the crustacea, the cosmopolitan inhabitant of salt water lakes, *Artemia*, that the inhabitants collect these animals in masses and knead them up with dates and an alga which also grows in the lake to form a repast which is highly esteemed. An *Artemia* occurs in the Great Salt Lake in Utah; the species in the present case is *A. Oudneyi*.

A long chapter on the climate and diseases of Fezzan follows, in which the maladies are described with an amount and character of detail which, though highly valuable, is perhaps more befitting a strictly medical publication than a general book on travel with a more or less popular aim. Similar medical details are given throughout the book and sometimes seem very much out of place. The native notions of medical treatment are curious and primitive. Thus patients suffering from cancer of the breast must most carefully abstain from all food derived from animals provided with tails, even such as milk and butter. To promote fruitfulness in women young suckling hares are prescribed. No one in Fezzan doubts that it is possible for a child to remain dormant within the mother for years or even for ever and this theory is most conveniently made use of when mishap necessitates it by wives whose husbands have been absent on very long journeys. As an aphrodisiac the fat of a Manatee, *Manatus Vogellii*, is used. The drug is sold at a high price being brought from the River Binûe a tributary of the Kowara in which the animal is abundant. Diseases are believed to be caused either by evil spirits or by the action of the evil eye.

During his exploration of Tibesti Dr. Nachtigal experienced many dangers and difficulties, losing his way, and suffering from want of water and forced night marches. A very interesting account is given of the ceremonials observed by the Tubu people in greeting one another. A most elaborate performance is gone through when two strangers meet in this wild country. Each of

the performers covers all his face but his eyes with his turban, seizes his spear and throwing iron (a curious boomerang-like weapon with a long projecting prong on the concave margin), and thus prepared the two approach one another. At a distance of about six steps from one another they squat on their heels with spear upright in one hand and iron in the other. The one then asks "How do you do?" about a dozen times by means of four different words having that meaning used alternately, the reply being varied of the use of two words Laha, or Killala.

Then one of the two loudly sings the word "İhilla," which is returned by the other in a similar tone. The word is exchanged again and again, being commenced in a loud high pitched note and gradually run down the scale until it reaches a low bass murmur. When it has become so low as scarcely to be heard, on a sudden it is shouted again in high key and the gamut is run through as before. This goes on for a very long while, the performers going through it as a strict matter of ceremony, and taking no interest in one another all the while but looking round at the horizon or elsewhere during their vocal exertions. After a while various forms of the question "How are you?" and the answer "Well," are introduced, at last questions or other topics are brought forward, although now and again the "İhilla" bursts out in the midst of them, but the series of notes in which it is shouted becomes shorter and shorter. At last the İhilla is got rid of altogether and ordinary conversation becomes possible. Strangers do not shake hands, but acquaintances do. The covering of the face when greeting or meeting strangers is considered as a most important matter of etiquette.

In the Zuar Valley the large baboons (*Cynocephalus babuin*) were met with in great numbers climbing on the rocks and trees, and, on account of their greenish grey colour, hardly to be distinguished from the tree trunks and stones. They tumble about amongst trees beset thickly with thorns many inches long without hurt. The Tubu do not molest them, partly because they are afraid of their strength and partly from superstitious motives.

On the cliffs bounding the river Udéno, near Bardai, in the centre of Tibesti, the author found a series of rude drawings of the same kind as those discovered by Barth in the north-eastern Tuârik region. The drawings are incised on the stone and represent almost without exception oxen with the horns bent forwards, all of which have a rope attached to the horns and drawn forward as if they were being led by it; some have on their backs the pack-saddle now used for oxen in Sudan. That the drawings were not inspired by reminiscences of the pack cattle of Sudan is shown by the circumstance that the leading rope is attached to the nostrils of the oxen and by the absence of the hump in them. The drawings are probably very ancient and date back from a time when cattle were used as beasts of burden in the country, and camels as yet not introduced. Barth remarked on the entire absence of the camel from amongst the very numerous drawings examined by him, in the present instance one drawing of a camel does occur, but Dr. Nachtigal thinks it has been probably added by a later hand in imitation of the ancient drawings. There is one figure of a man, a warrior of life size, with a spear in one hand and

in the other a shield of a different form from that now used in Tubu and curiously enough divided into four fields by a cross.

Dr. Nachtigal had a hard time of it in Bardai, being kept a prisoner in his camp and cruelly stoned by crowds of girls of 12 or 14 years of age, if he attempted to move out. The children evidently thought it good fun stoning him as well as their religious duty to do so. They watched him closely in case he should dare to steal out during quiet hours and rallied one another with the shout of "at the heathen." Sometimes a drunken man joined in the sport with his throwing-iron and made matters very serious indeed. It was of no avail for Dr. Nachtigal to give the children sugar, or other presents, or to attend the sick; as soon as the presents were secured or the visit to the patient completed, the volleys of stones came flying as before. It was just before his flight from Bardai that Dr. Nachtigal heard of the murder of Miss Tinne; the news hastened his departure, and he returned to Fezzan.

A chapter is devoted to the natural productions of Tu. The best camels of the Eastern part of the Great Desert are bred by the Tubu. They belong to that variety of the animal which is peculiar to the Central and Southern Sahara, and which is distinguished at first glance from the Northern or Arab camel. The latter has short limbs, stout body, heavy head and neck, and shaggy hair; the former is higher on the legs and lighter built with smooth hair. The Arab variety looks built for weight-carrying, the Tuârik animal for pace.

The fat-tailed sheep of the coast does not occur in Tibesti, the sheep of the region having long legs, a long thin tail and pretty long black shining hair instead of wool.

The throwing irons of the Teda are curious weapons of boomerang form beset with projecting prongs of various shapes. They are double-edged in parts and single-edged with a stout back in others. The handle is bound with leather to give a firm grip.

The weapon is thrown horizontally with great precision and terrible effect. Children practise with a piece of bent flattened wood sharpened on one edge in imitation of the throwing iron and carry also a wooden tipped spear. Being thus accustomed to carry weapons in their hands all their lives, the full-grown men when they are about their dwelling-places where they are strictly forbidden by custom to carry actual arms, return to the weapons of their childhood and carry about the wooden spear and throwing weapon.

The illustration given by the author of his reception by the Sultan of Bornu may be compared with the similar reception accorded to Denham and Clapperton so many years ago, and with their illustration of the ceremony. The then Sultan when he received Denham and Clapperton was concealed behind a lattice which was dispensed with in Dr. Nachtigal's case. Amongst the presents conveyed by the present author were life-sized portraits of the King and Queen of Germany and of the Crown Prince.

We cannot follow Dr. Nachtigal further, or pick out more interesting matter. The book seems to us rather too long and somewhat spun out; it is most sumptuously got up, with two large maps, well bound, and is full of good illustrations. Of these latter no list is given nor any information as to the sources from which those which

have appeared before are derived. The familiar figure in Denham and Clapperton's work of a mail-clad warrior and horse of Bornu is copied without any kind of acknowledgment. Very slight differences have been made in the present figure: thus in it the great toe only is placed in the stirrup instead of the whole foot, as in the original, and the ear-blade is double instead of single, whilst the helmet has a plume added, but all the rest is directly copied without any reason being given for the alterations. A most remarkable defect in the book, considering that it is German and scientific, is the almost entire absence of references to former works of all kinds. As far as we have been able to discover there are only two references to other books in the entire work, one to Fournel's "Les Berbes," the other to the publications of the German Geographical Society. Though Barth and Duveyrier are mentioned and their views are quoted, no references to their writings are given. And Denham and Clapperton are entirely ignored even in the account of Bornu. A serious drawback is that the book is published so long after the travels to which it relates were completed. We hope that the second volume may not be long in appearing. We understand that the book is shortly to be published in English. It is full of interesting and valuable matter and of scientific details.

THE SCIENCE OF AGRICULTURE

First Lessons in the Science of Agriculture; for Use in Indian Elementary Schools or Classes. Pp. 67. By J. B. Fuller. (Calcutta: Stanhope Press, 1879.)

THIS little primer is issued under the authority of the Department of Agriculture and Commerce, North-West Provinces and Oudh. If its teachings be accepted and followed by those for whom they are intended, increased and improved crops must be the consequence. Of course, within the narrow limits of some seventy small pages, we cannot expect to find the scientific basis of the art of agriculture fully developed; indeed, the explanations of the materials and processes with which Indian farming is concerned are neither numerous nor full. But to show clearly a few of the worst mistakes made by Eastern cultivators of the soil, and to indicate remedies and improved methods of procedure in but half-a-dozen cases, is a useful beginning of an important work. We note, in passing, a few examples of the recommendations, based upon scientific knowledge, which Mr. Fuller makes in these "First Lessons." On p. 7 the usefulness of a good tilth and of a feeding-ground deepened by thorough ploughing for crops during seasons of drought, is illustrated and enforced. We learn from pp. 26 and 27 that due importance is not generally attached to the selection and securing of the best varieties and qualities of seed for sowing the fields. Too often they sow any seed they have by them, the produce of their own fields, and often of inferior quality. Good kinds of grain, &c., are thus found to be confined to one village, though they might be grown successfully in many neighbouring places. Thus, the village of Jaláli in the Aligarh district is well known for its fine white wheat; Sánkni, in Bulandshahar, for its safflower; some districts north-west of Allahabad for indigo, and Hinganghát for cotton. The value of new

plants to India is discussed on pp. 31 and 32, the cases cited being tea, the potato, reana, and Egyptian cotton. Passing over a chapter in which some elementary facts about plant-food are given, we find many useful remarks (pp. 37 to 44) on the fertility of the soil and the means of restoring or increasing it. Here we are introduced to *reh* and *usar*. The former term is applied to the saline efflorescence, which, in some seasons especially, appear in many tracts of land in the North-West Provinces and elsewhere in India. *Reh* consists mainly of sodium and calcium sulphates, with some common salt and nitrates. The *usar* plain is infected with *reh*, but I cannot agree with Mr. Fuller in condemning the *usar* soils as sterile through deficiency of plant-food (p. 38). My analyses of such soils gave in most cases no evidence of deficiencies in the mineral elements of plant-nutrition, they merely showed an excess of soluble salts. What Mr. Fuller says about the best way of getting rid of *reh* is very judicious, so are his remarks about the sad waste of animal and vegetable residues (including indigo waste, and the bones of bullocks and buffaloes, in India)—residues which, instead of being burnt or neglected, should certainly be much more largely than at present ploughed into the land. His contrast between the work of the Indian plough and the English, the latter doing in one ploughing what the former needs twelve ploughings to accomplish, should be of some real service, especially as the new English-pattern ploughs made at Cawnpore are very light, and do not cost more than eight rupees apiece. By the use of this improved implement the "pan," which has been formed two or three inches under so large a tract of Indian soil by the rubbing of the old ploughshares and the trampling of the bullocks, would be broken up, and the rains would penetrate and moisten a much greater depth of soil. Mr. Fuller illustrates the advantage of increasing by such deep ploughing the depth of water-holding soil. He says: "In Madras, in the year 1878, when there was a great famine from the failure of the rains, some land was ploughed with the European plough, and some with the native plough, on the Government farm. Neither was irrigated, and both had to depend for their water on the little rain that fell. The European-ploughed land gave a rice-crop of six maunds per acre; the native-ploughed land did not yield a single grain." The two last lessons in this useful little book contain some quite satisfactory explanations as to the respective merits of canal and well water, and of thin and thick seeding in India.

A. H. C.

OUR BOOK SHELF

On the Crystallography of Calcite. By J. R. McD. Irby, B.Sc., of Lynchburg, U.S. (Bonn: Charles Georgi, 1878.)

ONE is pleased to find that, in an essay on the crystallography of calcite, by a gentleman who has received his training in America and Germany, the system of representation used by Prof. Miller has been adopted, and not the objectional modification employed by Professors Groth and Dana, jun. One regrets that the paper is unaccompanied by a stereographic projection, which would have much simplified the discussion of the distribution and position of the forms.

The original part of the essay consists of a criticism